Actuarial Skills Development Adviser

DAI Project No 2311-202

Mission Report

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1. Introduction

The main purpose of this technical assistance was to provide a course in actuarial basics in regard to property and casualty insurance, including reference to solvency, capital adequacy and regulatory issues. The TA was also required to make recommendations regarding establishment of scientific approaches towards premium, reserves and solvency margin determination.

In order to achieve the actuarial skills transfer, a four module teaching presentation was prepared and presented to the participants. As well, the participants were tested on the contents of the modules. At the request of the participants, an additional module on actuarial basics in regard to life insurance and pensions was presented.

This report also discusses issues in relation to a scientific approach to premiums, reserves and solvency margins. No specific are provided in this report, for reasons discussed below, although general comments in regard to the required approaches to these issues are provided.

2. Scope of work

The objectives of the TA are to:

a) establish setting premiums and reserves and a method of analysing insurance company solvency
b) transfer actuarial skills to ISA staff
c) transfer actuarial skills to insurance company personnel

The outputs anticipated are

- determine appropriate indicators for amendments to the Insurance Law of Mongolia
- create a credible actuarial presence in the ISA and insurance companies

3. Transfer of actuarial skills

To this end a teaching presentation consisting of four modules was prepared. These modules were

a) Premium calculations
b) Loss reserving
c) Capital adequacy and solvency
d) Regulatory issues and early warning tests

A fifth module, "Introduction to life insurance and pensions" was added at the request of the participants.

Participants were tested on the first four modules, and overall results of these tests were considered to be quite good. There was a good deal of variability, but many students scored over 90% in most of the tests. Thirty participant passed the course and were awarded certificates. The PowerPoint presentation is available at the Economic Policy Support Project.

Generally speaking, completing an actuarial qualification (for example Fellow of the Society of Actuaries or Fellow of the Institute of Actuaries) takes 4 to 5 years, usually after completing a degree in mathematics, economics or actuarial science (in this latter case there might be some overlap in the time taken to complete the degree and professional qualifications). Before studying the specifics of actuarial science, students generally need to be proficient in advanced mathematics, probability and statistics and economic theory.

In North America there are two separate examining bodies, the Society of Actuaries, which deals with life insurance and pensions and the Casualty Actuarial Society, dealing, as the name implies, in property and casualty actuarial science. There is some overlap between the two syllabuses and the early part is common. In the United Kingdom there is only one examining body, the Institute of Actuaries[1], and actuaries need to study both branches of actuarial science.

It therefore goes without saying that a 5 week course can only begin to provide transfer of actuarial skills. The test results indicate that most participants were able to absorb the teaching material, nonetheless, some participants clearly did not have the basic mathematical education that is a prerequisite to understanding more advanced topics. Even the better educated participants will need to review the material frequently in order to be able to apply the knowledge in the future.

Absence of quality data in Mongolia makes it difficult to apply the theory taught in the course to practical exercises. It is hoped however, that the participants will be able to apply some of the teaching to their own work.

[1] There is a Faculty of Actuaries in Scotland, but the two bodies cooperate very closely

Limited knowledge of English by most of the participants, as well as the difficulty the translators (who were themselves industry participants) had in translating and explaining technical terms and complex concepts also meant that teaching was challenging.

Having said all this, I am reasonably confident that the exposure to a scientific actuarial approach to premiums, reserving, solvency and regulation will be invaluable to the participants, but it should be emphasized that this course can only be viewed as the first step of a long process and not an end in itself. Recommendations on further steps are given in the concluding section.

3 Setting of premiums, reserves and solvency issues

The course provided the methodology usually used in developed countries to calculate these items.

Generally speaking, premiums should be based on losses expected to occur in the future. Such expected losses will be based on the observed losses, projected to take into account losses that have occurred but have not yet been reported to the company, as well as other loss developments. Further adjustments are required as outlined in the course and finally the premium rates to be charged can be calculated by loading for expenses and anticipated profit and contingency margins.

Reserves are set by estimating the expected losses from unexpired risks, generally as a function of unearned premiums. Reserves for losses that have already occurred are again based on the losses reported to the company and projected to take into account unreported losses, based on patterns of past loss development. Adjustments are required for future adjustment expenses.

Solvency margins generally require the setting up of regulatory capital. To some extent these margins are arbitrary. The asset margins would normally follow the Basel accord for assets, while appropriate margins would be required for unearned premiums and for loss reserves. In addition to regulatory capital, regulators would normally apply a number of early warning tests, which would require considerably more capital to pass, so regulatory capital is the bare minimum required and in fact companies are expected to have significantly more capital to be able to operate effectively.

Given that new legislation is in the process of being written, the current legislation being considered inappropriate for effective development and supervision of the industry, I cannot provide specific comments on the these issues in relation to current legislation. In point of fact I will be providing further guidance on these issues under a separate STTA.

Nonetheless, the comments below indicate generally what should be in legislation, regulation and other instruments.

Legislation

The Insurance Act should provide general guidance on the issues raised above. Given the inflexibility and difficulty of changing legislation in most jurisdiction it is not recommended that very detailed provisions be in the Act, nor indeed in the Civil Code articles dealing with insurance (in fact, very little should be in the Civil Code to prevent potential conflicts with other statutory instruments).

I would recommend that no specific regulation of premiums be in the legislation. In a competitive market, premium setting should be left to the market place.

In regard to reserves, legislation should cover the preparation of accounts in accordance with generally accepted accounting principles, and the setting up of reserve provisions in accordance with accepted actuarial principles. Provision should also be made in the legislation for the definition of actuary and the duties of the actuary. Finally the legislation should also provide for regulatory power to set solvency margins.

The legislation should also provide for the powers of the supervisor. This would include the power to request reports and inspection etc.

Regulation

The regulations could provide greater specificity in regard to calculation reserves, in an attempt to increase the soundness of the reserving mechanism. A definition of actuary would also be required, perhaps based on the acceptance of recognized actuarial qualification. There is an International Actuarial Association (IAA), but given the variability of qualification across the world, I would be reluctant to recommend that membership if this organization would be sufficient. It is to be hoped that a recognized actuarial body will be in existence in Mongolia within the foreseeable future.

The regulations should expand on the duties of the actuary and in particular his responsibility to inform the supervisory authority of any issues that are of concern to him. This might require some form of indemnification for actuaries reporting bona fide delinquencies to the supervisory authority.

It would be appropriate to include solvency margins in the regulations, bearing in mind that the reserves themselves might have quite a degree of uncertainty associated with them. Hopefully, as the reserving methodology improves, the solvency margins would become more meaningful, and might need to be adjusted accordingly. It is not desirable to be unnecessary stringent in setting statutory levels of reserves and solvency, given that a further objective should be to enhance and encourage competition in the market place. Excessive reserving requirements run counter to this objective.

Supervisory manual

A supervisory manual should include the principal early warning tests, as well as other information about the supervisor's attitude toward accounting and actuarial matters. This should be made available to the supervised companies. In this way, it is hope that standards will be improved with a greater deal of flexibility than is possible under a legislative approach. The approach can be adapted as the industry develops and matures.

Life insurance

The objective of the TA was to provide actuarial training on property and casualty matters. This was appropriate, given the virtual absence of private sector life insurance and pensions. Course members manifested a great interest in life insurance and pensions, and I responded by producing a very high level overview of the issues (including many of the problems that companies in developed countries experienced in the last few year, and not only because of turbulence in the stock market). It is probably appropriate that there be some mention of life insurance and pensions in the legislation, if only to be able to control pyramid schemes and Ponzi schemes (as per Albania and elsewhere), but any forays into life insurance and pensions should be done with a great deal of trepidation. Absence of long-term investments means that matching financial instruments are simply not available and the knowledge base for the more complex actuarial and other issues simply is not present. The first attempts at this kind of product should be low risk (for the insurer) savings products and even that could be initially done under government supervision.

It is also important to make sure that life insurance and property and casualty insurance are transacted under different corporate entities. While there is no objection to both companies belonging to one holding group, experience has generally been that supervision is much easier if there are separate corporate entities transacting each type of business. Some jurisdictions allow "composites", but best international practice is moving away from this arrangement.

4 Conclusion

In my opinion, a useful transfer of actuarial skills to personnel in the Mongolian insurance industry and the ISA was successfully accomplished. This was the first time that they were exposed to scientific methods in regard to the actuarial and mathematical issues related to insurance. In spite of the many difficulties associated with teaching in developing countries, the students were all very keen to learn and I believe they absorbed a lot in five weeks.

This is clearly only the beginning. The following steps should be considered in order to build appropriate body of actuarial and insurance professionals in Mongolia:

- More in-depth training is required
- One avenue is to look into the Chartered Insurance Institute in London England

- More in-depth actuarial training should be given to selected individuals both in the private sector and the government
- This would probably involve degree level training either in the United Kingdom or North America, or possibly in Asia (South Korea, or even China)
- Ideally students should be placed in an insurance company in one of these areas to get hands-on experience – this might be achieved by following "sandwich courses" which are available at some institutions
- Further training should also be contemplated in Mongolia in other topics, such as underwriting, loss adjustment, insurance accounting, as well as actuarial analysis

In the case of actuarial qualifications (Society of Actuaries in North America, Institute of Actuaries in the United Kingdom), the emphasis tends to be on life insurance and pensions. There is a Casualty Actuarial Society in the United States, which as the name implies concentrates on non-life issues. However, there may be a number of topics (such as workers compensation) that are of little use to Mongolian students. Fellows of the Institute of Actuaries are required to take some P&C papers, and may take an advanced paper in this topic. The SOA syllabus also has some P&C topics in it, although at an elementary level, given that actuaries wanting to specialize in P&C become FCAS.

It is possible that funding would be available from the actuarial bodies themselves, or through the various countries' overseas aid agency for students from developing and ex-Soviet countries. It would be worthwhile researching the availability of these funds.

The reason I have mentioned the Chartered Insurance Institute (which is not an actuarial body) is that it offers a broad education in P&C matters, including some actuarial analysis (at an elementary level). Some Mongolian insurance personnel have undoubtedly been exposed to this organization. This might be an appropriate educational path for those wanting a broader based education in insurance. Actuarial science is very specialized and while it can offer a lucrative career it is questionable that a market the size of Mongolia's can support very many of them. The CII offers a more reasonable alternative.

It should also be noted that most if not all of these courses, both actuarial and CII are available by correspondence, have been for many years, in some ways they were the pioneers of distance learning. However, it recommended that at least some on site education be obtained, firstly because the discipline required for distance learning can be quite formidable, secondly the students need exposure to more practical issues that are not available in Mongolia and thirdly it will be an opportunity to improve their language skills.

Finally, the entry into the Mongolian market of foreign companies might be an opportunity to improve Mongolian educational standards in these areas. Such companies should be encouraged to transfer Mongolian employees to head office or other offices for training. In fact they would likely do so anyway. The privatization of Mongol Daatgal will be interesting in this respect and may be an opportunity to expand actuarial and other professional insurance knowledge in Mongolia.

Respectfully submitted

Michael Cohen

Mongolia Actuarial Skills Project

Presented by
Michael Cohen
Ulaanbaatar - April 2003

Introduction

- Objectives of this course:
  - establish system to calculate insurance premiums
  - establish actuarial loss provisions
  - review solvency issues
  - transfer actuarial skills to ISA staff
  - transfer skills to insurance company personnel

Course approach

- General introduction to actuarial science
- Introduction to property and casualty actuarial issues

Course approach

- Four teaching modules
  - Module 1 - premium calculations
  - Module 2 - loss reserving
  - Module 3 - capital adequacy and solvency
  - Module 4 - regulatory issues, early warning tests

What is actuarial science?

- Actuarial science is a scientific approach to quantify future contingent events
- Two main elements are:
  - finance theory - compound interest
  - probability and statistics
- These elements are combined to provide sound basis for insurance and related areas

What is actuarial science?

- Two main areas of study:
  - life and non-life
  - life includes life insurance, pensions, disability and health insurance
  - non-life includes property and casualty, liability etc
- This course is about non-life insurance topics

Features of non-life insurance

- variously called “general insurance”, “property and casualty” or just “casualty”
- risks are generally short term
  - automobile and property claims often settled with a year or two
  - life insurance or pensions covers risks over decades
- some risks can be long term, e.g. product liability

Features of non-life insurance

- risks are very heterogeneous
  - automobile rates may depend on age of driver, type of car, geographic region, driving record etc
  - life and pensions much more homogeneous

Features of non-life insurance

- risks are very volatile
  - loss can be minor accident to total write-off
  - liability losses can be many millions of dollars
  - natural disasters can cause immense and correlated losses

Discussion

- What are the consequences of these features
  - Short terms versus long term?
  - Heterogeneous versus homogeneous?
  - Volatility?
- What other features can you think of?

Module 1

Premium Calculations

Module 1 - Premium Calculations

- Sound premium consists of charge for:
  - expected loss for risk
  - expenses
  - profit and contingency margins
- Premium must be compromise between
  - adequacy and
  - competitiveness in market

Module 1 - Premium Calculations

- Two methods
  - pure premium method
  - loss ratio method
- will describe the methods first
- then compare them

Module 1 - Premium Calculations

- Pure premium method
- Basic formulas
  - $P=L/E$
- P = pure premium
- L = losses
- E = exposure

Module 1 - Premium Calculations

- Also can be expressed:
  - $P = C/E \times L/C$
- C = claims count
  - $P = F_1 \times S$
- F_1 = frequency per unit of exposure
- S = severity

Module 1 - Premium Calculations

- Expenses, profit and contingencies
  - $R = (P+F)/(1-V-Q)$
- R = rate per unit of exposure
- P = pure premium
- F = fixed expenses per exposure
- V = variable expense factor
- Q = profit and contingency factor

Module 1 - Premium Calculations

- Example:
- loss and loss adjustment pure premium = $75
- fixed expense per exposure = $12.50
- variable expense factor = 17.5%
- profit and contingency factor = 5%

Module 1 - Premium Calculations

- Rate equals
- ($75 + $12.50)/(1-.175-.05) = $112.90 per unit exposure
- Pure premium = $75.00
- Fixed expenses = $12.50
- Variable expenses ($112.90x.175) =$19.76
- Profit and contingency ($112.90x.05) =$5.64

Discussion

- Discuss various types of expense
  - loss adjustment
  - other expenses
- why are they treated differently?
- Profit and contingency - what factors affect this loading?

Module 1 - Premium Calculations

- Loss ratio method
- Basic formulas:
  - $R=A \times R_0$
- R = indicated rate
- R_0 = current rate
- A = adjustment ratio W/T

Module 1 - Premium Calculations

- W = experience loss ratio
- T = target loss ratio
  - $T = (1-V-Q)/(1+G)$
- V = premium related expense factor
- Q = profit and contingency factor
- G = non-premium expense factor

Module 1 - Premium Calculations

- $W = L/(E \times R_0)$
  - L = experience losses
  - E = experience period exposure
- $R = L(1+G)/E(1-V-Q)$

Module 1 - Premium Calculations

- Two methods compared

Pure premium	Loss ratio
Based on exposure	Based on premium
Existing rates not required	Existing rates required
Does not use on-level premium	Uses on-level premium
Produces indicated rates	Produces indicated rate changes

Discussion

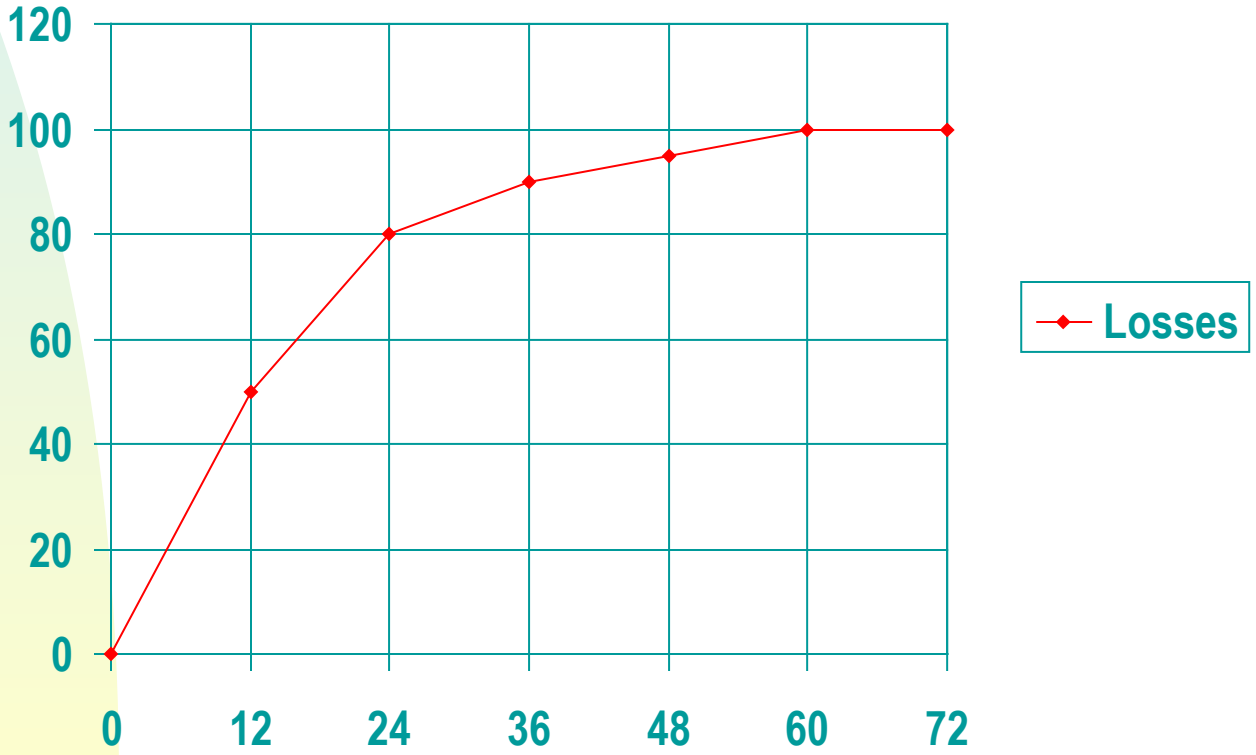
- Compare two methods
- show algebraic equivalence
- we will work out example after discussing loss and exposure calculations

Module 1 - Premium Calculations

- We now need to see how to calculate
  - expected ultimate losses
  - earned exposures
  - on-level premiums
- also need to discuss rating structure

Module 1 - Premium Calculations

- Expected ultimate losses
- losses only develop over time



Module 1 - Premium Calculations

- Use the **loss development method** to project claims to ultimate
- table in next slides shows claims count (losses) by
  - accident year - year loss occurred
  - accident year age, in months

Module 1 - Premium Calculations

- Accident year reported count development data

Accident year		Age 12	Age 24	Age 36	Age 48	Age 60	Age 72
1997		1804	2173	2374	2416	2416	2416
1998		1935	2379	2424	2552	2552	
1999		2103	2384	2514	2646		
2000		2169	2580	2722			
2001		2346	2783				
2002		2337					

Module 1 - Premium Calculations

- Age-to-age development factors

Accident year	12 - 24	24 - 36	36 - 48	48 - 60	60 - 72
1997	1.2045	1.0925	1.0177	1.0000	1.0000
1998	1.2295	1.0189	1.0528	1.0000	
1999	1.1336	1.0545	1.0525		
2000	1.1895	1.0550			
2001	1.1863				

Module 1 - Premium Calculations

- Typical age-to-age development factors obtained by inspection (more on this in loss reserving module)
- age-to-ultimate factors obtained from age-to-age factors
- projected ultimate claims by accident year can now be derived

Module 1 - Premium Calculations

- Projected ultimate losses

Accident year		Accident year age	age-to-age factor	age to ultimate	reported claims EOY 02	projected ultimate claims
1997		72		1.0000	2416	2416
1998		60	1.0000	1.0000	2552	2552
1999		48	1.0000	1.0000	2646	2646
2000		36	1.0450	1.0450	2722	2844
2001		24	1.0550	1.1025	2783	3068
2002		12	1.1900	1.3120	2337	3066

Module 1 - Premium Calculations

- Calculation of severity and identification of trends
- severity = average claim amount
- trends can be calculated on linear or exponential basis
  - linear assumes equal incremental amounts
  - exponential assumes equal incremental percentages

Module 1 - Premium Calculations

- Trended severity

Accident year	Projected losses and expenses		Projected claims	projected severity	least squares regression	
1997	3928.8		2416	1626	1606	
1998	4425.5		2552	1734	1757	
1999	5081.7		2646	1921	1907	
2000	5790.1		2844	2036	2058	
2001	6760.2		3068	2203	2209	
2002	7288.4		3066	2377	2360	

Module 1 - Premium Calculations

- Trended frequency

Accident year	Projected claims	Earned exposures	projected frequency	exp least square regression	
1997	2416	37846	0.0638	0.0647	
1998	2552	39771	0.0642	0.0638	
1999	2646	42135	0.0628	0.0630	
2000	2844	45231	0.0629	0.0621	
2001	3068	48583	0.0632	0.0613	
2002	3066	52267	0.0587	0.0605	

Module 1 - Premium Calculations

- Development of rate level change
  - calculate target loss ratio
  - calculate trended on-level premiums and allocated expenses ratio
  - percentage increase or decrease can then be developed
- same data can be used to calculate pure premium

Module 1 - Premium Calculations

- Target loss ratio
  - commissions = 15%
  - taxes, other fees = 2.25%
  - other acquisition expenses = 5.6%
  - general expenses = 6.8%
  - premium based expenses = 29.65%
  - unallocated loss expenses (as %age of losses and allocated expenses) = 6.42%

Module 1 - Premium Calculations

- Target loss ratio equals
- (1 - .2965)/(1 + .0642)
- 66.11%

Module 1 - Premium Calculations

- Indicated loss ratio

Accident year	Projected loss	Trend factors		Trended losses	On-level premium	Loss ratio
		severity	frequency			
2000	5790.1	1.2930	0.9479	7096	9832	72.18%
2001	6760.2	1.2048	0.9606	7824	10576	73.98%
2002	7288.4	1.1278	0.9736	8003	11404	70.18%
	19838.7			22923	31812	72.06%

Module 1 - Premium Calculations

- Indicated rate level change equals
  - actual loss ratio divided by target loss ratio
  - 72.06/66.11
- rate increase of 9% is indicated
- average premium was $217
- new premium should be $237

Module 1 - Premium Calculations

- Pure premium is
- trended severity times trended frequency divided by loss ratio
- 2661.3 * .0589 / .6611
- equals $237

Module 1 - Premium Calculations

- Earned exposure
  - amount of exposure to loss during the period
  - written, earned and in-force exposures can be illustrated as follows:
- example:
  - one policy written each quarter

Module 1 - Premium Calculations

- Exposures

Effective	Written exposure		Earned exposure		In-force exposure	
date	2002	2003	2002	2003	01-Jan-03	
01-Jan-02	1	0	1	0	0	
01-Apr-02	1	0	0.75	0.25	1	
01-Jul-02	1	0	0.5	0.5	1	
01-Oct-02	1	0	0.25	0.75	1	
Total	4	0	2.5	1.5	3	

Module 1 - Premium Calculations

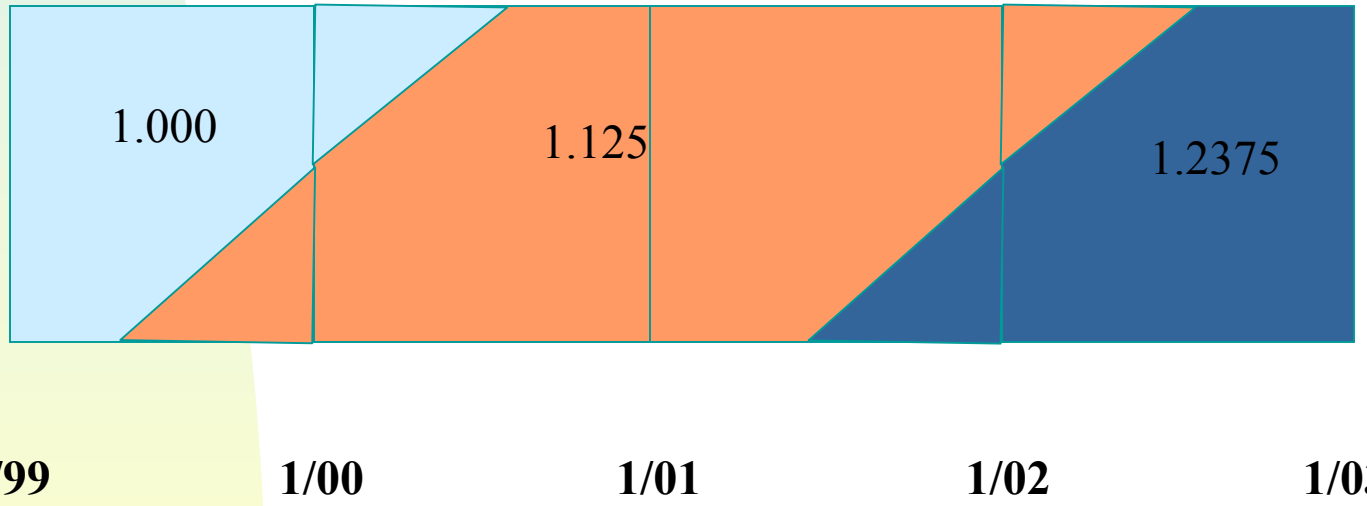
- On-level premium
  - for loss ratio method loss ratio is based on trended losses divided by premiums
  - premiums must be adjusted for rate changes during period of study
  - adjusted premiums are called **on-level premiums**

Module 1 - Premium Calculations

- On-level premium factors
- if premiums increased
  - 17.8% effective July 1, 1997
  - 12.5% effective July 1, 1999
  - 10.0% effective July 1, 2001
- first increase pre-dates period under study

Module 1 - Premium Calculations

- On-level premiums
- diagram illustrates impact of premium increases



Module 1 - Premium Calculations

- On-level factor is 2002 factor divided by adjustment factors
- for example for 2000 adjustment factor is
  - (.125*1)+(.875*1.125)=1.1094
- on-level factor is
  - 1.2375/1.1094=1.1155

Module 1 - Premium Calculations

- Calculation of on-level factors

Calendar	Proportion of earned at relative level				On-level
year	1	1.125	1.2375		factor
2000	0.125	0.875	0		1.1155
2001	0	0.875	0.125		1.0864
2002	0	0.125	0.875		1.0115

Module 1 - Premium Calculations

- Calculation of on-level premium

Calendar year	Calendar year earned premium		On-level factor	On-level earned premium	
2000	1926		1.1155	2148	
2001	2300		1.0864	2499	
2002	2563		1.0115	2592	
Total	6789			7240	

Module 1 - Premium Calculations

- Miscellaneous topics for discussion
  - classification rates
    - homogeneity of risk versus excessive sub-classification
  - impact of limits and layers
  - reinsurance
  - credibility

Module 1

Premium Calculations -

End of Module 1

Module 2

Loss reserving

Loss reserving

- Two category of reserves
  - unearned premium reserve
  - reserve for claims
- unearned premium reserves are for premiums at risk of loss
- reserve for claims are for events that have already occurred

Loss reserving

- Unearned premium reserves are easy to calculate
- policy terms are usually short (one or two years)
- premium can be considered to be earned pro-rata over term
- 50% of written premium good estimate

Loss reserving

- Estimation of losses already occurred more difficult
- reserve consists of
  - known claims
  - development of known claims
  - claims occurred but not reported
- losses include allocated adjustment expenses

Loss reserving

- Reserve estimation strategy
  - review data
  - apply reserve estimation techniques
  - evaluation of results of various methods
  - prepare projections of reserve development

Loss reserving

- Data organization
  - organize data in familiar triangular format
- exploratory data analysis
  - rate of development
  - smoothness of development
  - large losses
  - volume of data

Loss reserving

- Analysis of data will help in identifying
  - appropriate projection methodology
  - anomalies in data
  - further exploration with management of company

Loss reserving

- Triangles that could be examined
  - cumulative incurred losses
    - incurred losses = paid losses + case reserves
  - cumulative paid losses
  - incremental incurred losses
  - incremental paid losses

Loss reserving

- Triangles that could be examined
  - paid claims as %age of incurred claims
    - test consistency of development of paid and reported losses
    - useful for alternative reserving mechanism
  - reported claim count
    - indicative of lag in reporting

Loss reserving

- Triangles that could be examined
  - closed paid claim count
  - no-claim count
  - closed as %age of reported claims count
  - open claims count
  - average open claim amount
  - increase in average open claim

Loss reserving

- Triangles that could be examined
  - average closed claim
  - increase in average closed claim
    - reflects inflationary increases in settlements
  - closed claims as %age of open claims
    - indicative of condition of claims department

Loss reserving

- Reserving methodologies
  - triangular methods
  - reserve development methods
  - budgeted IBNR

Loss reserving

- Triangular methods
  - data arranged in triangular format
  - undeveloped loss years completed to expected ultimate pay-out
  - completion based on assumption that future years will develop in similar fashion to past

Loss reserving

- Data on cumulative paid losses

				Accident years				
Developed								
months		1996	1997	1998	1999	2000	2001	2002
12		22603	22054	20166	19297	20555	17001	11346
24		40064	43970	39147	37355	42898	33568	
36		54301	58737	51319	50391	62832		
48		64114	71841	60417	62347			
60		71257	78076	66402				
72		75950	81287					
84		78224						

Loss reserving

- Paid loss development factors
- e.g. $40,064/22603=1.773

				Accident years			
Developed							
months		1996	1997	1998	1999	2000	2001
12 to 24		1.773	1.994	1.941	1.936	2.087	1.974
24 to 36		1.355	1.336	1.311	1.349	1.465	
36 to 48		1.181	1.223	1.177	1.237		
48 to 60		1.111	1.087	1.099			
60 to 72		1.066	1.041				
72 to 84		1.030					

Loss reserving

- Look at various averages

Developed months		average	avg last 3	avg last 4	excl hi/lo
12 to 24		1.951	1.999	1.985	1.961
24 to 36		1.363	1.375	1.365	1.347
36 to 48		1.205	1.213	1.205	1.202
48 to 60		1.099	1.099	1.099	1.087
60 to 72		1.053	1.053	1.053	1.053
72 to 84		1.030	1.030	1.030	1.030

Loss reserving

- Loss development triangle can now be completed using these factors
- factors can take into account observed trends, so might differ from year to year
- development to ultimate is product of estimated factors

Loss reserving

- 84 to ultimate could be based on older data
- development to ultimate is product of estimated factors
- tables show
  - completed development factors
  - estimated claims to completion
  - reserves

Loss reserving

- Estimated loss development factors

				Accident years				
Developed months		1996	1997	1998	1999	2000	2001	2002
12 to 24		1.773	1.994	1.941	1.936	2.087	1.974	2.000
24 to 36		1.355	1.336	1.311	1.349	1.465	1.350	1.350
36 to 48		1.181	1.223	1.177	1.237	1.320	1.290	1.310
48 to 60		1.111	1.087	1.099	1.095	1.100	1.085	1.085
60 to 72		1.066	1.041	1.060	1.060	1.060	1.060	1.060
72 to 84		1.030	1.030	1.018	1.018	1.018	1.018	1.018
84 to ult		1.053	1.053	1.053	1.053	1.053	1.053	1.053
Dev to ult		**1.053**	**1.085**	**1.136**	**1.244**	**1.650**	**2.147**	**4.361**

Loss reserving

- Estimated reserve

				Accident years				
Developed								
months		1996	1997	1998	1999	2000	2001	2002
12		22603	22054	20166	19297	20555	17001	11346
24		40064	43970	39147	37355	42898	33568	
36		54301	58737	51319	50391	62832		
48		64114	71841	60417	62347			
60		71257	78076	66402				
72		75950	81287					
84		78224						
Paid to date		78224	81287	66402	62347	62832	33568	11346
Ultimate		82370	88163	75451	77573	103664	72071	49475
Reserve		4146	6876	9049	15226	40832	38503	38129
Total reserve								152762

Loss reserving

- This method can be used on different statistics to project ultimate claims
- incurred losses - paid losses plus case reserves
- number of claims
  - claims closed without payment
  - claims with indemnity

Loss reserving

- Average paid claims can also be developed
  - claims paid divided by claims with payment
- reserve derived from ultimate claim count multiplied by average claim for each year
- similar analysis can be performed on incurred claims

Discussion

- What are the characteristics of each method?
- What are the pros and cons of each method?

Loss reserving

- Reserve development methods
  - make use of historical relationship between incurred losses and paid losses
  - attempts to analyse adequacy of case reserves

Loss reserving

- Reserve development methods
  - easiest to interpret on report year basis
  - additional IBNR needed for this method

Loss reserving

- Case loss reserve by report year

Developed months	1996	1997	1998	1999	2000	2001	2002
12	46770	53422	41802	40334	47500	42219	30416
24	31944	36588	28899	28266	35455	27221	
36	18832	21214	15798	18312	22225		
48	9559	11345	9577	8724			
60	4999	8049	5403				
72	2821	3701					
84	1693						

Loss reserving

- Incremental paid by report year

Developed months	1996	1997	1998	1999	2000	2001	2002
12	30001	29421	26601	24981	27595	25886	15220
24	16021	18081	17078	15251	18196	17700	
36	14144	16904	13169	12665	17687		
48	8238	10811	7522	9465			
60	5923	4942	4739				
72	3119	2930					
84	1145						

Loss reserving

- Paid on reserve ratio by report year

Developed months	1996	1997	1998	1999	2000	2001
12 to 24	0.343	0.338	0.409	0.378	0.383	0.419
24 to 36	0.443	0.462	0.456	0.448	0.499	
36 to 48	0.437	0.510	0.476	0.517		
48 to 60	0.620	0.436	0.495			
60 to 72	0.624	0.364				
72 to 84	0.406					

Loss reserving

- Remaining in reserve ratio by report year

Developed months						
12 to 24	0.683	0.685	0.691	0.701	0.746	0.645
24 to 36	0.590	0.580	0.547	0.648	0.627	
36 to 48	0.508	0.535	0.606	0.476		
48 to 60	0.523	0.709	0.564			
60 to 72	0.564	0.460				
72 to 84	0.600					

Loss reserving

- Development of paid on open reserve amounts

Developed months	1996	1997	1998	1999	2000	2001	2002
12 to 24	0.343	0.338	0.409	0.378	0.383	0.419	0.420
24 to 36	0.443	0.462	0.456	0.448	0.499	0.500	0.500
36 to 48	0.437	0.510	0.476	0.517	0.500	0.500	0.500
48 to 60	0.620	0.436	0.495	0.500	0.500	0.500	0.500
60 to 72	0.624	0.364	0.500	0.500	0.500	0.500	0.500
72 to 84	0.406	0.400	0.400	0.400	0.400	0.400	0.400
84 to ult	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Loss reserving

- Development of open reserve amounts

	1996	1997	1998	1999	2000	2001	2002
Developed months							
12 to 24	0.683	0.685	0.691	0.701	0.746	0.645	0.690
24 to 36	0.590	0.580	0.547	0.648	0.627	0.635	0.635
36 to 48	0.508	0.535	0.606	0.476	0.530	0.530	0.530
48 to 60	0.523	0.709	0.564	0.600	0.600	0.600	0.600
60 to 72	0.564	0.460	0.500	0.500	0.500	0.500	0.500
72 to 84	0.600	0.600	0.600	0.600	0.600	0.600	0.600
84 to ult	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Loss reserving

- Case loss reserves by report year

Developed							
months	1996	1997	1998	1999	2000	2001	2002
12	46770	53422	41802	40334	47500	42219	30416
24	31944	36588	28899	28266	35455	27221	20987
36	18832	21214	15798	18312	22225	17285	13327
48	9559	11345	9577	8724	11779	9161	7063
60	4999	8049	5403	5234	7068	5497	4238
72	2821	3701	2702	2617	3534	2748	2119
84	1693	2221	1621	1570	2120	1649	1271
ultimate	0	0	0	0	0	0	0

Loss reserving

- Note that case losses are assumed to be fully developed by month 84
- selection of tail factor not an issue with this method

Loss reserving

- Incremental paid loss by report year

Developed	1996	1997	1998	1999	2000	2001	2002
months							
12	30001	29421	26601	24981	27595	25886	15220
24	16021	18081	17078	15251	18196	17700	12775
36	14144	16904	13169	12665	17687	13611	10494
48	8238	10811	7522	9465	11113	8643	6663
60	5923	4942	4739	4362	5890	4581	3532
72	3119	2930	2702	2617	3534	2748	2119
84	1145	1480	1621	1047	1414	1099	848
ultimate	1693	2221	1621	1570	2120	1649	1271

Loss reserving

- Tables on next slides give
  - Accumulated paid losses by report year
  - additional case reserves needed and
  - reported case reserve adequacy

Loss reserving

- Reserve development

Developed months	1996	1997	1998	1999	2000	2001	2002
12	30001	29421	26601	24981	27595	25886	15220
24	46022	47502	43679	40232	45791	43586	27995
36	60166	64406	56848	52897	63478	57197	38488
48	68404	75217	64370	62362	74591	65839	45152
60	74327	80159	69109	66724	80480	70420	48683
72	77446	83089	71811	69341	84014	73168	50802
84	78591	84569	73431	70388	85427	74267	51650
ultimate	80284	86790	75052	71958	87548	75917	52921

Loss reserving

- Reserve adequacy

	1996	1997	1998	1999	2000	2001	2002
reserves							
required	1693	3701	5943	9596	24070	32331	37701
carried	1693	3701	5403	8724	22225	27221	30416
additional case reserve needed							
	0	0	540	872	1845	5110	7285
Total							**15652**
reported case adequacy							
	100.0%	100.0%	90.9%	90.9%	92.3%	84.2%	80.7%

Loss reserving

- Budgeted IBNR
  - useful technique if incurred amounts reported over long period
  - in this case very little is reported in first 2 or 3 years
  - Budgeted IBNR technique smoothes out projected ultimates

Loss reserving

- Incurred loss data

Developed months	1996	1997	1998	1999	2000	2001	2002
12	58641	63732	51779	40143	55665	43401	28800
24	74804	79512	68175	67978	80296	57547	
36	77323	83680	69802	75144	87961		
48	77890	85366	69694	77947			
60	80728	88152	70041				
72	82280	87413					
84	82372						

Loss reserving

- Year to year development factors

Developed	1996	1997	1998	1999	2000	2001
months						
12 to 24	1.276	1.248	1.317	1.693	1.442	1.326
24 to 36	1.034	1.052	1.024	1.105	1.095	
36 to 48	1.007	1.020	0.998	1.037		
48 to 60	1.036	1.033	1.005			
60 to 72	1.019	0.992				
72 to 84	1.001					

Loss reserving

- Extrapolated development factors

		extrapolated dev factors					
Developed	1996	1997	1998	1999	2000	2001	2002
months							
12 to 24	1.276	1.248	1.317	1.693	1.442	1.326	1.400
24 to 36	1.034	1.052	1.024	1.105	1.095	1.070	1.070
36 to 48	1.007	1.020	0.998	1.037	1.020	1.020	1.020
48 to 60	1.036	1.033	1.005	1.020	1.020	1.020	1.020
60 to 72	1.019	0.992	1.000	1.000	1.000	1.000	1.000
72 to 84	1.001	1.000	1.000	1.000	1.000	1.000	1.000
84 to ult	1.010	1.010	1.010	1.010	1.010	1.010	1.010

Loss reserving

- Age to ultimate factors

Developed months	1996	1997	1998	1999	2000	2001	2002
12 to 24	1.419	1.385	1.366	2.000	1.660	1.491	1.574
24 to 36	1.112	1.110	1.038	1.181	1.151	1.124	1.124
36 to 48	1.076	1.055	1.013	1.069	1.051	1.051	1.051
48 to 60	1.068	1.034	1.015	1.030	1.030	1.030	1.030
60 to 72	1.031	1.002	1.010	1.010	1.010	1.010	1.010
72 to 84	1.011	1.010	1.010	1.010	1.010	1.010	1.010
84 to ult	1.010	1.010	1.010	1.010	1.010	1.010	1.010

Loss reserving

- Data imply that accident year is 99% developed by 60 months
- so 60 month to ultimate is given by factor of 1.01
- 2002 accident year is 63.5% reported (1/1.574)
- this means that 36.5% remains to be reported

Loss reserving

- Budgeted IBNR is this %age of ultimate reserve
- ultimate reserve can be estimated from earned premium multiplied by expected loss ratio from pricing assumptions

Loss reserving

- Budgeted IBNR method

				Accident year				
		1996	1997	1998	1999	2000	2001	2002
earned premium($000)		101.9	112.1	89.8	101.9	117.3	84.1	56.8
reported loss ratio		80.8%	78.0%	78.0%	76.5%	75.0%	68.4%	50.7%
expected loss ratio		80.0%	80.0%	80.0%	78.0%	78.0%	78.0%	78.00%
expected ultimate		81520	89680	71840	79482	91494	65598	44304
development to ult		1.010	1.010	1.010	1.030	1.051	1.124	1.574
remaining develm't		1.0%	1.0%	1.0%	2.9%	4.8%	11.1%	36.5%
remaining reserve		807	888	711	2330	4424	7255	16158
development to date		82372	87413	70041	77947	87961	57547	28800
ultimate estimate		83179	88301	70752	80277	92385	64802	44958
ultimate loss ratio		81.6%	78.8%	78.8%	78.8%	78.8%	77.1%	79.2%
paid claims		78224	81287	66402	62347	62832	33568	11346
reserve		4955	7014	4350	17930	29553	31234	33612
total								**128649**

Loss reserving

- Allocated loss adjustment expenses
  - can be analysed as %age of paid claims
  - then projected to ultimate in familiar manner

Loss reserving

- Paid loss history

				Accident years				
Developed								
months		1996	1997	1998	1999	2000	2001	2002
12		22603	22054	20166	19297	20555	17001	11346
24		40064	43970	39147	37355	42898	33568	
36		54301	58737	51319	50391	62832		
48		64114	71841	60417	62347			
60		71257	78076	66402				
72		75950	81287					
84		78224						

Loss reserving

- Paid allocated loss expense history

			Accident year				
Developed							
months	1996	1997	1998	1999	2000	2001	2002
12	554	485	446	405	388	357	216
24	1110	1244	1104	953	1025	843	
36	2118	2256	1981	1809	2161		
48	3231	3578	2973	2905			
60	4211	4567	3785				
72	4170	5202					
84	5429						

Loss reserving

- Expenses as %age of paid losses

			Accident year				
Developed months	1996	1997	1998	1999	2000	2001	2002
12	2.5%	2.2%	2.2%	2.1%	1.9%	2.1%	1.9%
24	2.8%	2.8%	2.8%	2.6%	2.4%	2.5%	
36	3.9%	3.8%	3.9%	3.6%	3.4%		
48	5.0%	5.0%	4.9%	4.7%			
60	5.9%	5.8%	5.7%				
72	5.5%	6.4%					
84	6.9%						

Loss reserving

- Development of %ages

			Accident year			
Developed						
months	1996	1997	1998	1999	2000	2001
12 to 24	1.130	1.286	1.275	1.216	1.266	1.196
24 to 36	1.408	1.358	1.369	1.407	1.439	
36 to 48	1.292	1.297	1.275	1.298		
48 to 60	1.173	1.174	1.158			
60 to 72	0.929	1.094				
72 to 84	1.264					

Loss reserving

- Complete triangle
- compute developed to ultimate

			Accident year				
Developed							
months	1996	1997	1998	1999	2000	2001	2002
12 to 24	1.130	1.286	1.275	1.216	1.266	1.196	1.3
24 to 36	1.408	1.358	1.369	1.407	1.439	1.400	1.400
36 to 48	1.292	1.297	1.275	1.298	1.295	1.295	1.295
48 to 60	1.173	1.174	1.158	1.160	1.160	1.160	1.160
60 to 72	0.929	1.094	1.025	1.025	1.025	1.025	1.025
72 to 84	1.264	1.010	1.010	1.010	1.010	1.010	1.010
84 to ult	1.010	1.010	1.010	1.010	1.010	1.010	1.010
dev to ult	1.010	1.020	1.046	1.213	1.571	2.199	2.859

Loss reserving

- Calculate ultimate expense ratio as %age of losses

			Accident year				
Developed							
months	1996	1997	1998	1999	2000	2001	2002
12	2.45%	2.20%	2.21%	2.10%	1.89%	2.10%	1.90%
24	2.77%	2.83%	2.82%	2.55%	2.39%	2.51%	
36	3.90%	3.84%	3.86%	3.59%	3.44%		
48	5.04%	4.98%	4.92%	4.66%			
60	5.91%	5.85%	5.70%				
72	5.49%	6.40%					
84	6.94%						
84 to ult	7.01%	6.53%	5.96%	5.65%	5.40%	5.52%	5.44%

Loss reserving

- Calculate reserve for allocated expenses

		1996	1997	1998	1999	2000	2001	2002
ultimate loss		82370	88163	75451	77573	103664	72071	49475
ultimate expenses		5774	5755	4497	4384	5600	3980	2693
paid		5429	5202	3785	2905	2161	843	216
reserve		345	553	712	1479	3439	3137	2477
total								12142

Loss reserving

- Unallocated loss adjustment expenses
  - overhead expenses to maintain claims department
  - calculated as %age of paid losses
  - need to separate out between
    - cost to establish claim
    - costs on pending claims

Loss reserving

- Unallocated loss expenses

			Calendar year						
		1996	1997	1998	1999	2000	2001	2002	all years
expenses		12345	13826	15486	17344	19425	21756	24367	124549
claims paid		91955	100576	111530	130708	145889	164051	171397	916106
%age		13.4%	13.7%	13.9%	13.3%	13.3%	13.3%	14.2%	13.6%

Loss reserving

- Unallocated loss expenses
  - suppose studies show 40% of expense is incurred on establishment of claim
  - reserve is
  - 13.6% of (IBNR + 60% of case reserve)

Loss reserving

- Miscellaneous topics
  - reserve discounting
  - reserve estimate ranges
  - stochastic claim reserves

Loss reserving

- Reserve discounting
  - traditionally future cash flows have not been discounted
  - this provides for margin for adverse contingencies
  - might be appropriate to allow for time value of money
  - however should also recognize impact of future inflation

Loss reserving

- Reserve discounting
  - use real rate of return (nominal rate minus expected inflation component)
  - or use expected rate of return, but with explicit allowance for inflation
  - some reserves (workers' compensation, disability settlements) generally discounted

Loss reserving

- Reserve estimate ranges
  - reserves calculated so far as “best estimates”
  - might be appropriate to look at “worst case” and “best case”
  - will return to this subject in next module
- stochastic claims reserves

Loss reserving

- Stochastic claims reserves
  - extension of claim reserve ranges
  - uses expected distribution of claims to find probabilistic results
  - not widely used as yet

Discussion

- Discuss the various approaches to reserving
- what are their pros and cons?
- What data are needed for the various methodologies?
- How suitable are they to Mongolian experience

Module 2

Loss reserving - end of Module 2

Module 3

Capital adequacy and solvency

Capital adequacy and solvency

- What is capital?
  - Capital is margin in balance sheet to allow insurer to absorb unanticipated losses
  - risks exist on both asset and liability sides of balance sheet
  - risks need to be managed
  - ultimately, capital ensures on-going solvency of insurer

Capital adequacy and solvency

- Where does capital come from
  - from subscribed capital in stock company and
  - from accumulated profits in stock and mutual companies
- profit margin should be built into pricing basis

Capital adequacy and solvency

- What should profit margin be?
  - In Module 1 we assumed profit margin as %age of premium
  - 5% has been traditional, but not based on scientific study
  - should really be based on
    - rate of return on capital employed plus
    - reward for risk taking

Capital adequacy and solvency

- Source of profit
  - in other words profit related to reward and risk
    - asset side of balance sheet
    - liability side of balance
  - %age of sales is wrong measure
  - but uncertainties in other measures makes 5% of premium good “rule of thumb”

Capital adequacy and solvency

- Statutory capital requirements
- following example shows typical requirement for statutory surplus for regulatory purposes
- in theory, more complex analysis required to determine appropriate levels of capital, but this approach is simple and consistent

Capital adequacy and solvency

- Assets
  - insurer should minimize risk on asset side of balance sheet
  - this is done by investing in high grade investments
  - insurer may invest small percentage in other investments to increase return on investments

Capital adequacy and solvency

- Capital factors for assets

0% capital factor

- Government bonds
- Government backed bonds
- Int'l org bonds

2% capital factor

- Term deposits
- Commercial paper
- Bonds & debentures

Capital adequacy and solvency

- Capital factors for assets

4% capital factor	• Preferred shares • Residential mortgages
8% capital factor	• Own-use real estate • Commercial mortgages

Capital adequacy and solvency

- Capital factors for assets

10% capital factor
- Other loans

15% capital factor
- Common shares
- Non-own-use real estate
- Mortgages on undeveloped land

Capital adequacy and solvency

- Capital factors for assets

Category	factor	amount	capital required
Gov't bonds	0%	50000	0
terms deposits	2%	15000	300
corp bonds	2%	5000	100
preferred shares	4%	1000	40
res morgages	4%	5000	200
real estate own use	8%	10000	800
unsecured loan	10%	2000	200
common shares	15%	5000	750
undev land	15%	2000	300
Total		95000	2690

Capital adequacy and solvency

- margin for liabilities
  - liabilities also need to be managed to reduce risk
  - however, risk taking is unavoidable in insurance company
  - capital on liability side required to absorb unanticipated losses
  - otherwise small deviations from normal would threaten solvency

Capital adequacy and solvency

- margin for liabilities
  - different margins appropriate for different lines
  - where claims are small and frequent less margin needed
  - where claims are large, infrequent and variable larger margin need
  - in practice, one margin may be satisfactory

Capital adequacy and solvency

- margin for liabilities

Class of insurance	Margin on unearned premiums	Margin on unpaid claims
Personal & commercial property	8%	5%
Automobile – liability & personal accident	8%	10%
Automobile – other	8%	5%
Liability	8%	15%

Capital adequacy and solvency

- Example

Class of insurance		unearned premiums		loss reserves	
	margin	liability	margin required	margin	liability	margin required
Personal & comm	8%	20000	1600	5%	10000	500
property						
auto - liab & personal	8%	20000	1600	10%	15000	1500
accident						
auto - other	8%	20000	1600	5%	5000	250
liability	8%	20000	1600	15%	15000	2250
Total		80000	6400		45000	4500

Capital adequacy and solvency

- Example

		liability	margin
Unearned premium		80000	6400
reserve			
Loss reserves		45000	4500
Total		125000	10900

Discussion

- Are these ratios appropriate for the Mongolian market?
- what modifications could be suggested?
- what is the trade-off between simplicity and fairness?

Capital adequacy and solvency

- Rate of return measures
  - traditionally, investment income has been ignored, or at least treated separately
  - **combined ratio** is sum of
    - loss ratio and
    - expense ratio

Capital adequacy and solvency

- Combined ratio uses different denominators for two item, as they tend to be incurred differently
  - loss ratio is incurred losses, including loss adjustment expenses divided by earned premiums
  - expense ratio is other expense divided by written premiums

Capital adequacy and solvency

- In recent years combined ratio for many companies above 100%
- this means they are making **losses** on underwriting and claims payments
- reason was that investment income made company profitable

Capital adequacy and solvency

- Dangerous strategy when investment earnings also turn negative
- alternative is to use **operating ratio**
- operating ratio equals
  - combined ratio minus
  - investment earning divided by earned premium

Capital adequacy and solvency

- Some issues remain
- how to define investment income
- realized and unrealized capital gains present problems
- nonetheless, this measure gives some basis for looking at overall profitability of company

Capital adequacy and solvency

- Examples of various operating ratios

					Years		
			1	2	3	4	5
Combined ratio			112.0	118.0	116.5	108.0	104.6
Net investment income			14.9	15.4	14.6	13.2	12.7
Operating ratio I			97.1	102.6	101.9	94.8	91.9
Net investment gain			16.9	18.0	18.7	17.3	14.4
Operating ratio II			95.1	100.0	97.8	90.7	90.2
Net investment gain,			18.1	15.5	22.7	18.5	12.8
incl unrealized gain/loss							
Operating ratio III			93.9	102.5	93.8	89.5	91.8

Capital adequacy and solvency

- Risk theory
  - examples so far have been on **deterministic** basis
  - in reality statistics are subject to **stochastic process**
  - we try to determine the underlying distribution and project forward
  - deterministic results are means (averages) of underlying process

Capital adequacy and solvency

- Projections subject to two types of risk
  - parameter risk
  - process risk
- parameter risk is risk that underlying parameters are incorrect
- process risk is inherent uncertainty involved in projecting future events

Capital adequacy and solvency

- Probability of ruin
  - solvency and required capital can be treated within “probability of ruin” framework
  - how much capital is required to ensure that probability of ruin over given time horizon is below stated figure (e.g. 5%)?

Capital adequacy and solvency

- Probability of ruin
  - this can be answered by stochastic analysis
  - use *Monte Carlo* technique
  - simulate large number of scenarios
  - find amount of capital to survive worst scenarios

Capital adequacy and solvency

- Analytical methods
  - fit data to probability distribution
  - use distribution to find appropriate solution
  - simple distributions (e.g. normal) generally not satisfactory
  - “fat tailed” distribution, e.g. Pareto, need to be used

Capital adequacy and solvency

- Useful for analysing impact of limits
- useful for reinsurance, where first slice is excluded
- can also give analytical answers to risk loading and probability of ruin questions

Discussion

- Discuss some simple examples of risk theory
  - fit claims pattern to simple distribution (e.g. Poisson)
  - then risk loading is function of standard deviation

Module 3

Capital adequacy and solvency - end of Module 3

Module 4

Regulatory issues - early warning tests

Regulatory issues

- Objectives of financial sector regulation
  - enhance public confidence in financial institutions
  - safeguard policyholders from undue loss
  - promote competition in industry

Regulatory issues

- This module will concentrate on actuarial/financial aspects of regulation and supervision of property and casualty insurance companies
- other topics, e.g. risk based supervision, can be discussed in class

Regulatory issues

- Two main issues
  - financial analysis
  - early warning tests
- financial analysis
  - supervisors need to understand rate-making and loss reserving process
  - need to understand the underlying assumptions

Regulatory issues

- Financial analysis
  - function is not to second-guess company
  - nor to check their arithmetic
  - need to be able to challenge dubious assumptions
  - need to look at “worse case” scenarios
  - need to detect excessive optimism

Regulatory issues

- Early warning tests

Test number	Name of test	Definition	Usual range
1	Change in net writing	Change in net premiums written	-33% to +33%
2	Change in gross writing	Change in gross premiums written	-33% to +33%
3	Net risk ratio	Net premiums written/(capital + surplus)	Up to 3X
4	Gross risk ratio	Gross premiums written/(capital + surplus)	Up to 7X

Regulatory issues

- Early warning tests

Test number	Name of test	Definition	Usual range
5	Change in capital and surplus	Increase/decrease in capital + surplus	-10% to +50%
6	Amounts due from agents	Amount due as %age of capital and surplus	Up to 50%
7	Surplus aid	Related to ceded premiums	Up to 25%
8	Capital and surplus ratio	(capital + surplus)/(net liabilities + reserves required)	Minimum 25%

Regulatory issues

- Early warning tests

Test number	Name of test	Definition	Usual range
9	Investment risk ratio	Common shares/(capital + surplus)	Up to 100%
10	Investment yield	2 x I/(A + B – I)	Depends on rates of return, but at least 5%
11	Liabilities as %age of liquid assets	Net liabilities /(assets excluding real estate)	Up to 105%

Regulatory issues

- Early warning tests

Test number	Name of test	Definition	Usual range
12	Loss reserves to surplus	(net reserve for claims and adjustment expenses)/(capital and surplus)	Up to 2.5X
13	Return on capital and surplus	Net income/two year average assets minus liabilities	Depends on rates of return, but at least 6%
14	One year development as %age of capital and surplus	Excess or deficiency in respect of last year's reserve /(capital + surplus)	Up to 25%

Regulatory issues

- Early warning tests - what do they mean?
  - Tests have shown to be important
  - values outside range correlated with developing financial problems

Regulatory issues

- Early warning tests
- change in net writing
  - signals change in reinsurance patterns
  - sudden contraction problematic
  - sudden expansion also problem
    - loss of control
    - maybe inadequate rates

Regulatory issues

- Early warning tests
- change in gross writing
  - also signals volatility in business
  - contraction means insufficient revenue to cover overhead
  - expansion signals loss of control

Regulatory issues

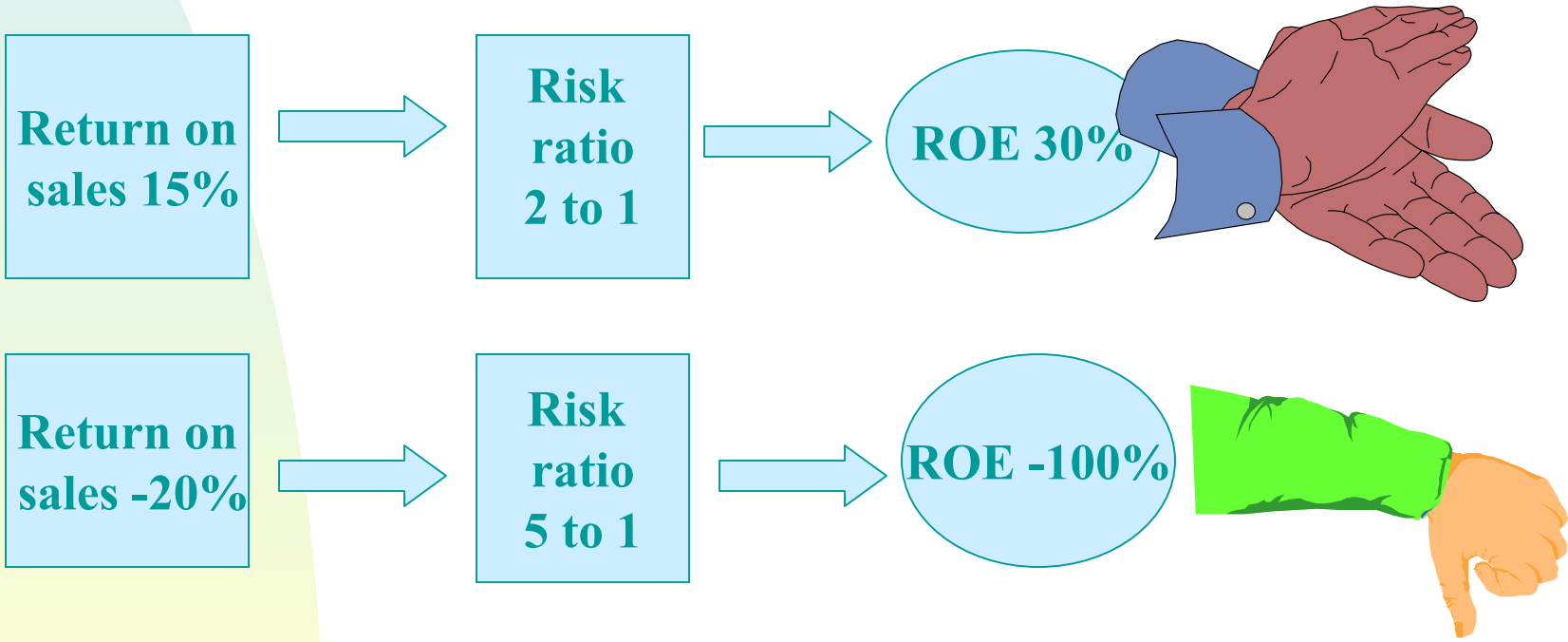
- Early warning tests
- risk ratio
  - NI/NPW X NPW/CS = NI/CS
  - NI = net income (underwriting plus investment)
  - NPW = net premiums written
  - CS = capital & surplus

Regulatory issues

- Early warning tests
- risk ratio
  - return on sales (NI/NPW) times
  - risk ratio (NPW/CS) equals
  - return on equity (NI/CS)
- why it is important shown by example

Regulatory issues

- Early warning tests



Regulatory issues

- Early warning tests
- gross risk ratio
- same as net risk ratio, but before reinsurance
- reinsurance reduces volatility so higher ratio permissible

Regulatory issues

- Early warning tests
- change in capital and surplus
  - signals instability in cushion against insolvency
  - drop most worrying
  - significant increase should also be investigated

Regulatory issues

- Early warning tests
- amount due from agents and related parties
  - signals lack of confidence in company
  - if agent becomes insolvent would have impact on company's financial position

Regulatory issues

- Early warning tests
- surplus aid
  - signals that company is over-dependent on reinsurance
  - surplus may in fact be mostly reinsurance commissions
  - this leave company vulnerable

Regulatory issues

- Early warning tests
- capital & surplus as %age of liabilities
  - insurer's "leverage"
  - smaller capital base compared to liabilities, less insurer is able to weather "shocks"

Regulatory issues

- Early warning tests
- investment risk ratio
  - common stock riskier than fixed income securities
  - company should avoid excessive risk from asset side of balance sheet
  - at limit putting 15 to 30% of C&S at risk each year

Regulatory issues

- Early warning tests
- investment yield
  - compare with market rates
  - low rate indicates poor investment performance
  - high rate could indicate excessive risk

Regulatory issues

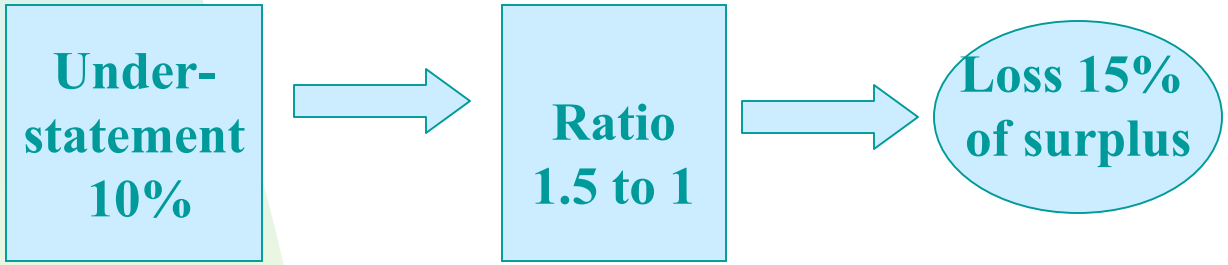
- Early warning tests
- liabilities as %age of liquid assets
  - large percentage of claims payable within one year
  - liquid assets essential to ensure funds available when needed
  - ratio above 105% indicates possible liquidity crisis

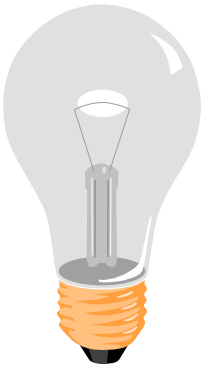
Regulatory issues

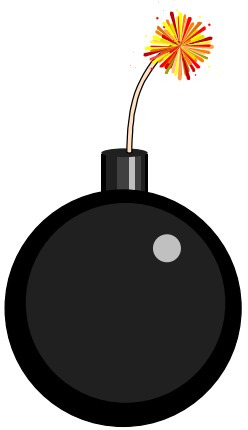
- Early warning tests
- loss reserves to surplus
  - also leverage measure
  - understatement of claims liability eats into surplus
  - again, illustrated by way of example

Regulatory issues

- Early warning tests







Regulatory issues

- Early warning tests
- return on capital & surplus
  - fundamental measure of financial health
  - rate of return on shareholder capital
  - if low or negative why would shareholders put in more money

Regulatory issues

- Early warning tests
- return on capital & surplus
  - critical question
  - if company in financial difficulties, regulators will push for more capital
  - where will this come from?

Regulatory issues

- Early warning tests
- one year loss development to capital & surplus
  - liability for claims, including IBNR largest single liability
  - also most difficult to assess
  - development gives some indication of gap between actual and expected

Regulatory issues

- Early warning tests
  - if this is greater than 10% of capital & surplus means
    - claims will probably be turn out to be considerably greater than reserved for
    - capital and surplus is overstated by a significant, but unknown amount

Regulatory issues

- Early warning tests
  - ratios are **flags** that warrant further investigation
  - few ratios outside normal range does not necessarily signal a problem
  - on the other hand, deterioration of ratios, even within normal range, may be worrying sign

Regulatory issues

- Early warning tests
- indicators are probably poorer in developing countries than in developed ones
- need to calibrate ratios for this market
- gives companies benchmarks to work towards to ensure financial health

Regulatory issues

- Early warning tests
- basic financial indicators and trends also powerful tools
  - underwriting results
  - expense level
  - and so on

Module 4

Regulatory issues - early warning tests - end of Module 4